Factors Affecting Rooting of Rhododendron maximum and Kalmia latifolia Stem Cuttings

Ross F. Williams and Theodore E. Bilderback
Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650

Abstract. Stem cuttings of Rhododendron maximum L. and Kalmia latifolia L. were successfully rooted when treated with a talc formulation of 2,4,5-trichlorophenoxypropionic acid (fenoprop), K. latifolia cuttings taken in September rooted better than cuttings propagated in October or November. Rooting response was the same among native populations or field-grown stock. Osmocote (18N-2.6P-10K) incorporated in the rooting medium reduced rooting.

Rhododendron maximum and Kalmia latifolia, native to mountains and wooded areas of the eastern United States, are in demand as landscape plants (3). In the past commercial growers have collected native plants after pruning them severely and then growing them for 4 to 6 years in the field to attain salable size. High labor costs and objections from environmentalists have recently reduced the production of collected stock, suggesting propagation by cuttings as a desirable alternative.

It is recommended (4, 7) that cuttings should be taken from the current year’s growth, after maturation. Fordham (4) and Bradshaw (1) reported success in rooting K. latifolia with a 0.1% talc formulation of fenoprop, and a liquid dip of indolebutyric acid (IBA) and naphthaleneacetic acid (NAA) each at 5000 ppm. Successful rooting (70 to 100%) has been reported using 1.0% fenoprop for some hard-to-root hybrids of rhododendrons (8). Bridgers (2) reported a 60% rooting response of R. maximum cuttings treated with 0.8% IBA dispersed in talc (Hormodin #3) plus ferric dimethyldithiocarbamate (ferbam). Rooting of K. latifolia varies by clone (6), juvenility (1) or light effects on stock plants (5).

The objective of this study was to determine the influence of rooting hormones, month of propagation, sources of cuttings (native vs. field-grown stock), and fertilizer incorporation in the propagation medium on rooting of R. maximum and K. latifolia stem cuttings.

R. maximum and K. latifolia stock plants were selected in September, October, November of 1977 from 3 sources: 1) shaded, natural stands of mature plants; 2) 4- to 5-year-old cutback plants growing in full sun in Watauga and Avery counties in the mountains of western North Carolina at an altitude of 1110 m; and 3) juvenile basal sprout cuttings of 2-year-old collected plants (K. latifolia only). Twenty plants of each source were used for each species. Only terminal stem cuttings of the current year’s growth were collected for fall propagation.

Rooting beds in a heated greenhouse at the Mountain Horticultural Crops Research Station at Fletcher, North Carolina were filled with 12 cm of equal parts pasteurized acid peat moss and perlite. Alternate randomized sections in the beds were amended with 1.2 kg/m³ Osmocote from 2 sources of cuttings. Each value is an average of 5 cuttings/replication representing 80 cuttings. Analysis was made on the mean rooting percentage and rootball diameter of 5 cuttings per replication with 4 replications each month. Cuttings were arranged in a split plot design. R. maximum cuttings remained in the propagation bed for 135 days, K. latifolia cuttings for 165 days. No rating scale was used to evaluate cuttings, as cuttings either developed a branched root system or failed to root.

Highest rooting percentages resulted with fenoprop-treated cuttings for R. maximum and K. latifolia (Tables 1 and 2), consistent with earlier reports (1, 4, 8). Rootball diameters were similar for all fenoprop-treated cuttings and for R. maximum cuttings treated with 0.5% K-IBA 10-sec dip.

K. latifolia cuttings propagated in September rooted at higher percentages than cuttings propagated in October and November. Rooting response was the same among native populations or field-grown stock. Osmocote (18N-2.6P-10K) incorporated in the rooting medium reduced rooting.

Table 1. Influence of propagation month and hormone treatments on rooting percentage and rootball diameter of R. maximum.

<table>
<thead>
<tr>
<th>Hormone treatment</th>
<th>Month</th>
<th>Rooting (%)</th>
<th>Rootball diam (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0% fenoprop + talc</td>
<td>Sept.</td>
<td>73 a</td>
<td>6.0 x</td>
</tr>
<tr>
<td>1.0% K-IBA + Benomyl + talc</td>
<td>Oct.</td>
<td>78 a</td>
<td>5.8 a</td>
</tr>
<tr>
<td>0.5% K-IBA 10-sec dip</td>
<td>Nov.</td>
<td>45 b</td>
<td>4.7 abc</td>
</tr>
<tr>
<td>0.5% K-IBA + NaOH (pH 10.5) 10-10 min soak</td>
<td>Oct.</td>
<td>32 d</td>
<td>4.6 abc</td>
</tr>
<tr>
<td>0.5% K-IBA + NaOH (pH 10.5) 10-10 min soak</td>
<td>Nov.</td>
<td>33 c</td>
<td>4.9 abc</td>
</tr>
</tbody>
</table>

Table 2. Influence of propagation month and hormone treatments on rooting percentage and rootball diameter of K. latifolia.

<table>
<thead>
<tr>
<th>Hormone treatment</th>
<th>Month</th>
<th>Rooting (%)</th>
<th>Rootball diam (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1% fenoprop + talc</td>
<td>Sept.</td>
<td>55 y</td>
<td>5.7 b</td>
</tr>
<tr>
<td>1.0% K-IBA + Benomyl + talc</td>
<td>Oct.</td>
<td>30 b</td>
<td>6.8 b</td>
</tr>
<tr>
<td>0.5% K-IBA 10-sec dip</td>
<td>Nov.</td>
<td>23 b</td>
<td>7.2 b</td>
</tr>
<tr>
<td>0.5% K-IBA 10-sec dip</td>
<td>Oct.</td>
<td>35 b</td>
<td>6.1 b</td>
</tr>
<tr>
<td>0.5% K-IBA 10-sec dip</td>
<td>Nov.</td>
<td>33 c</td>
<td>6.2 b</td>
</tr>
</tbody>
</table>

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1 Received for publication October 25, 1979. Paper No. 6512 of the Journal Series of the North Carolina Agricultural Research Service, Raleigh, NC. The use of trade names does not imply endorsement by the North Carolina Agricultural Research Service of the products named nor criticism of similar ones not mentioned.

2 Graduate Assistant, Department of Horticultural Science (Present address: North Carolina Agricultural Extension Service, Greensboro, NC 27420).

3 Assistant Professor, Department of Horticultural Science.
for all 3 hormone treatments (Table 2). November cuttings tended to have the largest rootball diameters, possibly due to greater space in the propagation bed when September and October cuttings were removed and evaluated. R. maximum cuttings propagated in September rooted at higher mean percentages than cuttings propagated in November. Cuttings in September and October treated with 1.0% fenoprop rooted better and had larger root systems than other treatment combinations (Table 1).

Rooting percentage of cuttings was reduced with the incorporation of 1.2 kg/m² Osmocote in R. maximum for all hormone treatments, months of propagation and sources of cuttings. Incorporation of Osmocote in the propagation medium over combined treatments resulted in reduced rooting in K. latifolia but was not less within hormone treatments. Propagation of R. maximum cuttings from 2 sources, native populations and mature field grown plants, resulted in equal rooting and equal rootball diameters (32% and 36% and 5.5 cm and 6.1 cm, respectively). This was also true for K. latifolia cuttings propagated from 3 sources. Rooting percentage ranged from 31% and 71 cm diameters for juvenile (2 year) collected plants to 25% and 6.4 cm rootball diameters for mature (5 year) collected plants. These values were combined means of 72 cuttings for R. maximum and 96 cuttings for K. latifolia.

Our results indicate that best rooting was obtained with 1.0% fenoprop for R. maximum and 0.1% fenoprop for K. latifolia (Tables 1 and 2). K. latifolia cuttings propagated in September rooted better than cuttings taken in October and November (Table 1). Rooting percentage and rootball diameter were the same for cuttings taken from native populations or field grown collected stock.

### Literature Cited


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**Growth Response of European Birch Seedlings to Daylength and Root Pruning**

Robert J. Kelly2 and Roy A. Mecklenburg3

Department of Horticulture, Michigan State University, East Lansing, MI 48224

Additional index words. root dormancy, root pruning, photoperiod

Abstract. Seedlings of European birch (*Betula pendula* Roth.) grew rapidly (3.4 cm/week) in long days (8 hours of natural light plus 2 hours of supplemental light in the middle of the dark period). Two weeks of short days (8 hours of natural light) inhibited shoot growth and prompted the onset of dormancy. Daylength did not effect the rate of root growth. Root pruning suppressed the rate of root growth for 2 weeks, but once active tips were formed the rate of growth was similar to unpruned roots. Complete defoliation or covering of the foliage on short day dormant plants terminated root growth.

In many plants active root growth occurs throughout the year with the ratio of active to dormant roots varying with season (1). Root growth almost entirely ceases in cold or dry soil conditions (3, 8, 12, 13). In transplanting a substantial portion of the actively growing (unsuberized) roots are removed. At this time absorption of water and nutrients through the secondary-thickened (suberized) roots becomes important (2, 9).

Daylength effects the duration of shoot growth of certain woody species (5, 11). On daylength-sensitive species, short days hasten and long days delay the onset of dormancy at any season. Low light levels or defoliation reduced root growth rates (1, 5, 14). Species of *Betula* respond to photoperiod (10, 11). Induced dormancy may be overcome by either long photoperiods (6) or chilling (14). The objective of this study was to evaluate photoperiod on shoot and root growth in European birch. After preliminary results were examined the study was expanded to include defoliation and foliage covering.

The root chamber system utilized in this study was adopted from de Stigter (4). A light-tight chamber (46 cm long, 30.5 cm wide, 5 cm high) was made from black plexiglass with a removable aluminum lid. This chamber allowed for observation of all plant parts with minimum damage. A dilute nutrient solution was supplied to seedlings 10 cm tall (shoot) in a trickle irrigation system (7). The solution dripped continuously moistening a piece of black acetate cloth lining each container. A complete nutrient solution (200 ppm N, 90 ppm P, 165 ppm K, mg/L) of macronutrients and micronutrients at the rate of 1 liter per hr was delivered continuously to each chamber containing a single seedling. The plant's root system grew directly on the moist acetate cloth. The chambers were on a slight slant which allowed the excess solution to drain off.

Greenhouse temperatures were maintained at 20 ± 3°C. Black cloth was used to control daylength. There were 3 photoperiod treatments: short day (8 hr of natural light), long day (8 hr of natural daylight plus a 2 hr night interruption of 20-26 lux in the middle of the dark period), and ambient.

Root response of short day dormant (2 weeks of short days) plants to transplanting and leaf area reduction was investigated. Transplanting was simulated by pruning the root system to remove about 1/3 of the total area. Leaf area reduction was studied by treating the leaf blades on the entire shoot, the lower half or the top half by either defoliation or covering with thin aluminum foil envelopes.

The experimental design was a split plot with treatments as the whole plot...